

Patent Claims:

1. An openable and closable umbrella that is used for protection against the weather, e.g. sun and/or rain, and where any rain water falling on it is deflected outward by a shape of a canopy, characterized in that
5 arms (30) supporting the canopy (10) are wholly above the canopy (10) and do not pass through the canopy (10).

2. The umbrella according to claim 1, characterized in that the umbrella has

10 a shaft (20) anchorable in or on the ground or in the air by an anchor (51),

a canopy (10) that is in open condition wavy, made of a preferably nonstretching membrane or fabric, formed of a whole number of polygonal sections with corner (12) defining alternating
15 high points (34) and low points (35), centrally traversed by the shaft (20), centrally axially slidable along a vertical umbrella axis (1) or preferably centrally fixed on the shaft (20), movable from a closed folded position inclined to the axis (1), and having an outer edge (11), and

20 at least one arm (30) extending radially from and pivoted on the shaft (20) and extending in an open unfolded position from the shaft (20) to corners (12).

3. The umbrella according to one of the preceding claims, characterized in that the canopy (10) has an even number $2n$ of high points (34) and low points (35) so it has n high points (34) and n low points (34) that alternate at the edge (11) of the canopy (10) in the open position and that impart to the canopy (10) a wavy shape, the high points (34) tensioning the canopy (10) up and out and the low points (35) tensioning the canopy (10) down and out.

4. The umbrella according to one of the preceding claims, characterized in that the canopy (10) has an even number $2n$ of high points (34) and low arms (32) with n high points (34) and n low arms (32) that alternate about the umbrella axis (1) and impart an alternating upwardly pushed and downward folded shape to the canopy, the high points (34) being at the outer edge (11) of the canopy (10) and drawing the canopy (10) upward and the lower arms (32) advantageously being secured to the canopy (10) over their entire length, in particular via a groove, and/or engaging it and drawing the canopy (10) downward.

5. The umbrella according to one of the preceding claims, characterized in that the canopy (10) has an even number $2n$ of upper arms (31) and low points (34) with n upper arms (31) and n low points (34) that alternate about the umbrella axis (1) and impart to the canopy an

alternating upwardly folded and downwardly forced shape, the upper arms advantageously being secured to the canopy (10) over their entire length, in particular via a groove, and/or engage it and draw the canopy (10) upward, the low points (35) being at the outer edge (11) of the canopy (10) and pushing the canopy (10) downward.

6. The umbrella according to one of the preceding claims, characterized in that the canopy (10) has an even number $2n$ of upper arms (31) and lower arms (32) with n upper arms (31) and n lower arms (32) that alternate about a shaft (20) and impart to the canopy an alternating upwardly and downwardly folded shape, all the upper arms (31) and lower arms (32) being above the canopy (10) and being secured at spaced locations or along their entire lengths, in particular via a groove, with the canopy (10) and or engaging it and alternately drawing the canopy (10) upward and pushing it downward.

7. The umbrella according to one of the preceding claims, characterized in that the canopy (10) has a predetermined number n of low points (35), the canopy (10) being drawn up to and geometrically intersecting the umbrella axis (1) at a center (13) so as to set a conical shape in the canopy (10).

8. The umbrella according to one of the preceding claims, characterized in that the canopy (10) has a predetermined number n of low arms (32), the low arms (32) being secured at spaced locations or along their entire lengths, in particular via a groove, with the canopy (10) and/or engage it so that they set along the low arms (32) a folded conical shape to the canopy (10).

9. The umbrella according to one of the preceding claims, characterized in that the canopy (10) has a predetermined number n of edge rods (15), the edge rods being secured at space locations or along their entire length with the respective canopy edge (11) and being alternately inclined to impart a wavy shape to the canopy (10).

10. The umbrella according to one of the preceding claims, characterized in that the canopy (10) is tensioned by a preferably elastic annularly closed canopy-edge bow (16), the edge bow (16) being secured at spaced locations or along its entire length with the canopy edge (11) and being oppositely inclined to impart a wavy shape to the canopy (10).

11. The umbrella according to one of the preceding claims, characterized in that at least one of the sections of the canopy (10) is replaced by a canopy-edge cable (14).

5 12. The umbrella according to one of the preceding claims, characterized in that the canopy (10) is also secured at the center (13) to the shaft (20) or to a sleeve (25), the shape of the canopy (10) being variable by changing the axial position along the shaft (20) of the
10 center (13) and/or of the sleeve (25).

13. The umbrella according to one of the preceding claims, characterized in that in the open position the canopy (10) is freely shiftable at the shaft (20) along the shaft (20) according to how much the canopy
15 (10) is tensioned, the canopy (10) being sealed at the center (13) to the shaft (20) and/or to the sleeve (25).

14. The umbrella according to one of the preceding claims, characterized in that in the open position the canopy (10) is freely shiftable at the
20 shaft (20) along the shaft according to how much the canopy (10) is tensioned, the canopy (10) being so cut out or constructed at the center (13) that it lightly touches or freely surrounds the shaft (20) and/or the sleeve (25).

15. The umbrella according to one of the preceding claims, characterized in that
in the open position the canopy (10) is freely shiftable at the shaft (20) along the shaft according to how much the canopy (10) is tensioned, the shaft (20) being supported from above and ending above the canopy (10) so that the canopy (10) is not cutout out where it intersects the umbrella axis (1) and only lightly touches the shaft (20) from below or is spaced from it.

16. The umbrella according to one of the preceding claims, characterized in that
a line in the canopy (10) between a corner (12) and the umbrella axis (1) is, due to a sewn-in strap or cable, straight when the canopy (10) is under not excessive tension, so that the canopy (10) forms a fold along the line between the corner (12) and the umbrella axis (1).

17. The umbrella according to one of the preceding claims, characterized in that
a line in the canopy (10) between a corner (12) and the umbrella axis (1) is, due to a sewn-in strap or cable, arcuate when the canopy (10) is under not excessive tension, so that the canopy (10) forms a fold along the line between the corner (12) and the umbrella axis (1).

18. The umbrella according to one of the preceding claims, characterized in that
a line in the canopy (10) between a corner (12) and the umbrella axis (1) has a shape determined to the static properties of the canopy (10), so that the canopy (10) is not folded along the line between the corner (12) and the umbrella axis (1).

19. The umbrella according to one of the preceding claims, characterized in that
the canopy edge (11) forms a curve seen from above, so that the canopy (10) when made robust is tensioned along the edge (11).

20. The umbrella according to one of the preceding claims, characterized in that
in the open position of the umbrella, longitudinal axes of the upper arms (31) intersect the umbrella axis (1) at a common point and the longitudinal axes of the lower arms (32) intersect the umbrella axis (1) at another common point, the longitudinal axes of the upper arms (31) and of the lower arms (32) intersecting the umbrella axis (1) at different common points.

21. The umbrella according to one of the preceding claims, characterized in that
in the open position of the umbrella some or all of the arms (30) are tensioned upward into positions necessary for the open position

by respective cables (40) extending between outer ends (33) and the shaft (20).

22. The umbrella according to one of the preceding claims, characterized in that
5 in the open position of the umbrella some or all of the arms (30) are tensioned upward into positions necessary for the open position by diagonal spreaders (43) that extend under tension or compression and are preferably pivoted between the arms (30) and the shaft (20).

10 23. The umbrella according to one of the preceding claims, characterized in that
in the open position of the umbrella some or all of the lower arms (32) are tensioned upward into positions necessary for the open position by the static properties of the canopy (10) held up by the
15 upper arms (31) and if necessary reinforced with straps or cables or of its parts, in particular the canopy edge (11), the canopy edge rods (15), the edge bow (16), or the edge cable (14).

24. The umbrella according to one of the preceding claims, characterized in that
20 in the open position of the umbrella some or all of the arms (30) are tensioned downward into positions necessary for the open position by cables (40) that are tensioned between the end points and the shaft (20).

25. The umbrella according to one of the preceding claims, characterized in that
in the open position of the umbrella some or all of the arms (30) are tensioned downward into positions necessary for the open
5 position by diagonal spreaders (43) that extend under tension or compression and are preferably pivoted between the arms (30) and the shaft (20).

26. The umbrella according to one of the preceding claims, characterized in that
10 in the open position of the umbrella some or all of the arms (30) are tensioned downward into positions necessary for the open position by the static properties of the canopy (10) if necessary reinforced with straps or cables or of its parts, in particular the canopy edge (11), the canopy edge rods (15), the edge bow (16), or
15 the edge cable (14).

27. The umbrella according to one of the preceding claims, characterized in that
the umbrella is opened by an opening and closing mechanism having a sleeve (25) or shiftable telescoping shaft tip (21) on which all
20 the arms (30) are pivoted, and that can move downward along the umbrella axis (1) so that all the arms (30) and the canopy (10) mounted on these arms (30) are pushed or pulled by cables (40) and/or diagonal spreaders (43) into positions necessary for the open position until the canopy (10) is fully tensioned and the

entire system assumes a stable position as a result of limits established by the static properties and geometry of the canopy (10) or its parts, in particular the canopy edge (11), the edge rods (15), the edge bow (16), or the edge cables (14) and/or by the cables (40) or diagonal spreaders (43).

28. The umbrella according to one of the preceding claims, characterized in that the umbrella is opened by an opening and closing mechanism having a sleeve (25) or shiftable telescoping shaft tip (21) on which all the arms (30) are pivoted, and that can move downward along the umbrella axis (1) so that all the upper arms (31) and the canopy (10) mounted on these arms (30) are pushed or pulled by cables (40) and/or diagonal spreaders (43) into positions necessary for the open position, all the lower arms (32) being drawn or pulled by the static properties and geometry of the canopy (10) or its parts, in particular the canopy edge (11), the edge rods (15), the edge bow (16), or the edge cables (14) and/or by the cables (40) or diagonal spreaders (43) into positions necessary for the open position until the canopy (10) is fully tensioned and the entire system assumes a stable position as a result of limits established by the static properties and geometry of the canopy (10) or its parts and/or by the cables (40) or diagonal spreaders (43).

20. The umbrella according to one of the preceding claims, characterized in that the umbrella is opened by an opening and closing mechanism having a sleeve (25) or shiftable telescoping shaft tip (21) or an element on the umbrella axis (1) not fixed on the shaft on which all the arms (30) are pivoted, and that can move upward along the umbrella axis (1) so that all the arms (30) and the canopy (10) mounted on these arms (30) are pushed or pulled by cables (40) and/or diagonal spreaders (43) into positions necessary for the open position, until the canopy (10) is fully tensioned and the entire system assumes a stable position as a result of limits established by the static properties and geometry of the canopy (10) or its parts, in particular the canopy edge (11), the canopy edge rods (15), the edge bow (16), or the edge cable (14) and/or by the cables (40) or diagonal spreaders (43).

30. The umbrella according to one of the preceding claims, characterized in that the umbrella is opened by an opening and closing mechanism having a sleeve (25) or shiftable telescoping shaft tip (21) or an element on the umbrella axis (1) not fixed on the shaft on which all the cables (40) or diagonal spreaders (43) are pivoted, and that can move upward along the umbrella axis (1) so that all the upper arms (31) and the canopy (10) mounted on these upper arms (31) are pushed or pulled by cables (40) and/or diagonal spreaders (43) into positions necessary for the open position, all the lower arms (32)

being drawn or pulled by the static properties and geometry of the canopy (10) or its parts, in particular the canopy edge (11), the edge rods (15), the edge bow (16), or the edge cables (14) and/or by the cables (40) or diagonal spreaders (43) into positions
5 necessary for the open position until the canopy (10) is fully tensioned and the entire system assumes a stable position as a result of limits established by the static properties and geometry of the canopy (10) or its parts and/or by the cables (40) or diagonal spreaders (43).

10 31. The umbrella according to one of the preceding claims, characterized in that
the umbrella is opened by an opening and closing mechanism having cables (40) or diagonal spreaders (43) that can be lengthened or shortened so that the cables (40) or the diagonal spreaders (43)
15 push or pull all the arms (30) and the canopy (10) mounted on these arms (30) into positions necessary for the open position, until the canopy (10) is fully tensioned and the entire system assumes a stable position as a result of limits established by the static properties and geometry of the canopy (10) or its parts, in
20 particular the canopy edge (11), the edge rods (15), the edge bow (16), or the edge cables (14) and/or by the cables (40) or diagonal spreaders (43).

32. The umbrella according to one of the preceding claims, characterized in that

the umbrella is opened by an opening and closing mechanism having cables (40) or diagonal spreaders (43) that can be lengthened or shortened so that the cables (40) or the diagonal spreaders (43) push or pull all the upper arms (31) and the canopy (10) mounted on these arms (30) into positions necessary for the open position, all the lower arms (32) being drawn or pulled by the static properties and geometry of the canopy (10) or its parts, in particular the canopy edge (11), the edge rods (15), the edge bow (16), or the edge cables (14) and/or by the cables (40) or diagonal spreaders (43) into positions necessary for the open position until the canopy (10) is fully tensioned and the entire system assumes a stable position as a result of limits established by the static properties and geometry of the canopy (10) or its parts, and/or by the cables (40) or diagonal spreaders (43).

33. The umbrella according to one of the preceding claims, characterized in that the sum of the lengths a of the arms (30) measured from the shaft (20) where they engage the respective diagonal spreaders (43) and the lengths d of the diagonal spreaders (43) is the same for all arms, where $a + d = \text{constant}$ so that in particular umbrellas with upper arms (31) and lower arms (32) can be completely folded together.

34. The umbrella according to one of the preceding claims, characterized in that the umbrella is closed by an opening and closing mechanism where all the arms (30) and the canopy (10) are secured at the center (13) to a common sleeve (25) so that lifting of the sleeve (25) raises the center (13) and the canopy (10) assumes a closed position folded together at the center.

35. The umbrella according to one of the preceding claims, characterized in that the umbrellas, in particular square, rectangular, or rhombic umbrellas, having low points at their corners (35) and only high points on their edge, can be grouped in rows so that rain water fall on them is directed outward and any gaps between canopies (10) of adjacent umbrellas can be closed by intermediate canopies (17).

36. The umbrella according to one of the preceding claims, characterized in that four square or rhombic umbrellas can be oriented in a square grouping, each umbrella having two upper arms (31) and two lower arms (32) and the umbrellas each have one long arm (31) in the center of the group so that falling rain water is directed outward and any spaces between the canopies (10) of adjacent umbrellas are closable by intermediate canopies (17).

37. The umbrella according to one of the preceding claims, characterized in that
the canopies (10) are reflective, lamps (60) being directed from
above and/or from below on the canopies (10), the lamps being
s preferably mounted on the shaft (20) or on a support (50) or being
set in the floor.